

THREE NEW DUPLOMINONA SPECIES (TURBELLARIA, MONOCELIDIDAE,
MINONINAE) FROM THE MEDITERRANEAN

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Paul M. Martens

Department SBM, Limburgs Universitair Centrum, Belgium (1)

Résumé

Trois espèces nouvelles du genre Duplominona (Turbellaria, Monocelididae, Minoninae) de la Méditerranée.

Trois nouvelles espèces de Minoninae (Proseriata, Monocelididae) du genre Duplominona sont décrites: Duplominona paucispina sp.n., Duplominona corsicana sp.n. et Duplominona longicirrus sp.n.

D. paucispina est caractérisée par un cirre court avec neuf épines égales de 5-5,6 μ m de long, D. corsicana a un cirre, long de 20 μ m avec de nombreuses épines de 1-1,5 μ m tandis que D. longicirrus a un cirre de 90 μ m avec de nombreuses épines très fines de 0.5 μ m. Un aperçu des caractères diagnostiques des 14 espèces connues actuellement dans le genre Duplominona est présenté sous forme d' une clef d' identification.

Les trois espèces nouvelles proviennent des fonds sablonneux infralittoraux de la Baie de Calvi, Corse.

Introduction

During several intensive collecting campaigns in 1982, 1983 and 1984 at the "Station de Recherches Sous-marines et Oceanographiques" (STARESO) at Calvi, (Corsica) about 200 species of marine micro-Turbellaria have been observed. Most of the collecting sites are infralittoral, down to 40 m depth and more, the majority of them with sandy bottoms and some with algae. Generally spoken the diversity in Turbellaria species in the Bay of Calvi is very high but densities are very low and only a few individuals per species were found.

In the present paper, three new species of the genus Duplominona from infralittoral habitats are described: D. paucispina sp.n., D. corsicana sp.n. and D. longicirrus sp.n. (Monocelididae, Minoninae). From the Mediterranean and its adjacent seas, only two Minoninae are known: Duplominona istambulensis (Ax, 1959) from the Black Sea and the Marmara Sea (Ax, 1959) and Minona trigonopora Ax, 1956 from the french mediterranean salt marches at Canet (Ax, 1956).

The caryology of Duplominona paucispina sp.n. and Duplominona corsicana sp.n. has been studied and the results of these studies will be published elsewhere.

Material and methods

All samples were taken by SCUBA-diving; the sampling stations are indicated under "Localities" for each species.

Turbellaria were extracted from the sand using the $MgCl_2$ method (see Martens, 1984). Whole mounts were prepared with lactophenol from the individuals studied alive. Other representatives of the species (if found in sufficient numbers) were fixed in Bouin's fluid and serially sectioned (5 μm). Sections were stained with Heidenhain's iron hematoxyline, using eosine as counterstain.

For species from which sectioned material is available the relative pore distances are given: a=mounth-vagina, b=vagina-male pore, c=male pore-pore of accessory organ, d=pore of accessory organ-female pore and e=female pore-caudal tip (see Karling, 1966 and Tajika, 1982).

Figures without a scale are freehand drawings, those with a scale were made with the camera lucida.

Type material is deposited in the zoological collection of Departement SBM, Limburgs Universitair Centrum, Diepenbeek, Belgium.

DESCRIPTION OF THE NEW SPECIES

DUPLOMINONA PAUCISPINA sp.n. (Fig. 1-8)

Material.

Several animals studied alive and mounted, two specimens sectioned sagittally, one of them designated as holotype.

Locality.

Bay of Calvi (Corsica), in different stations with sandy bottom from 10 to 35 m depth (type locality). Date : 9.VI.82, 16.V.83, 18,19,20,21,22,23.IX.83.

Derivation of the species name.

Refers to the low number of spines in the cirrus.

Description.

The living animals (Fig. 1-2) are 1.4-1.6 mm long and 0.1 mm broad, without eyes nor pigment, and have a rounded tail with adhesive papillae. The part in front of the gut is transparent with some oily drops. The pharynx lies between the second and the last third of the body. The body wall and the pharynx are of the same construction as in most Monocelididae (see Karling, 1966). The epidermis, 2-2.5 μ m high, contains small eosinophilic rhabdites (1 μ m long).

The topography of the genital organs in the living animals is shown in fig. 3. Eight testes lie medially in one row in front of the pharynx, the vitellaria stretch from about the same level as the first testis to just in front of the copulatory organ.

The copulatory organ is a globular muscular bulb (about 26 μ m long) the seminal vesicle and a short cirrus with nine relatively large spines. The spines are uniform in size and shape,

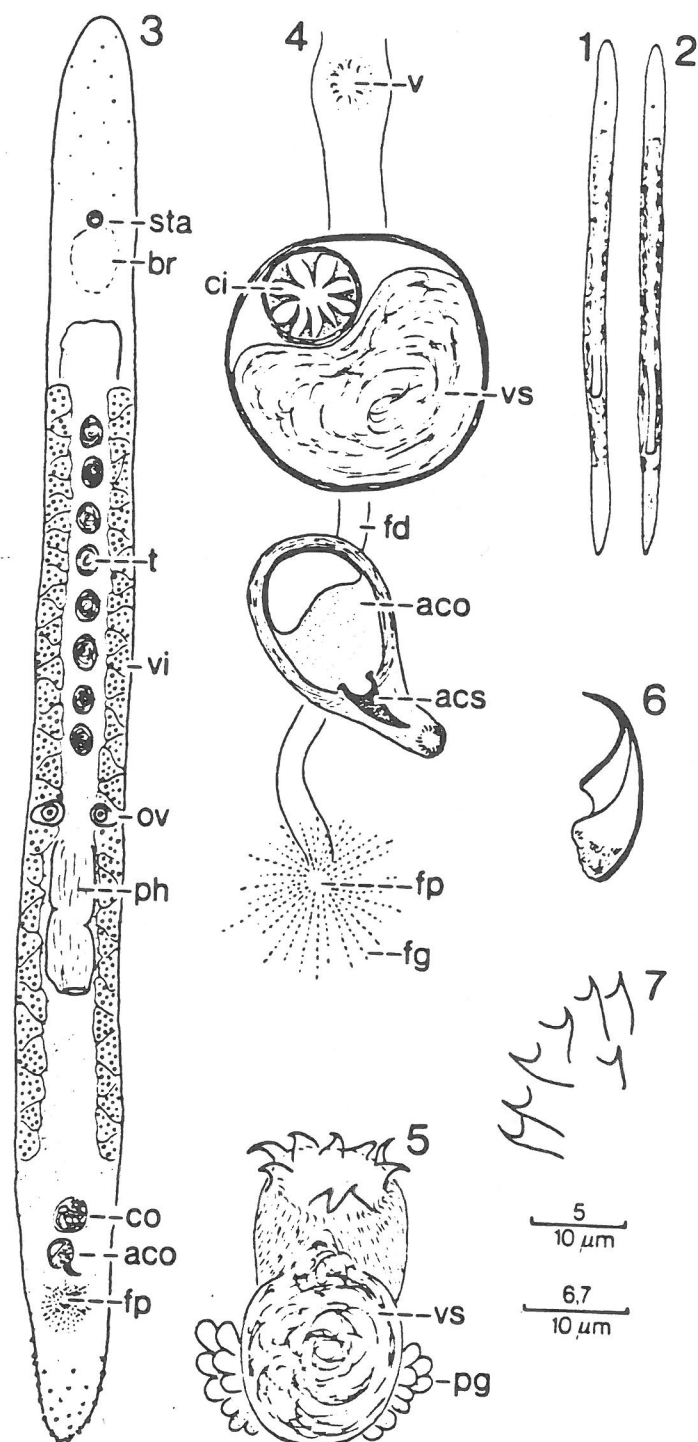


Fig. 1-7.-*Duplominona paucispina*. 1-2. Free swimming animals. 3. General organisation of living animals (dorsal view). 4. Genital organs in living animals. 5. Everted cirrus of the copulatory organ, from whole mount. 6. Stylet of the accessory organ, from the whole mount. 7. Some spines of the cirrus, from whole mount.

5-5.6 μm long and 5 μm broad at the base and attached to the cirrus wall at the same level. In the moderately squeezed living animals with dorso-ventrally orientated cirrus they look as the spokes of a wheel (Fig. 4) and in the everted cirrus they form a girdle at its top (Fig. 5).

No delimited prostate vesicle is present, only the distal part of the epithelium of the seminal vesicle seems to be secretory containing a very fine granular secretion (Fig. 8). In squeezed and in sectioned material a few prostate glands are found at the left and the right side of the copulatory bulb (Fig. 5).

The bulb of the accessory organ ("prostatoid") is situated behind the copulatory organ and apparently contains two kinds of secretion: rather coarse and basophilic in the proximal end of the bulb and fine and eosinophilic in the distal part. In the living animal, however, the proximal part of the reservoir looks empty much like a large vacuole (Fig. 4 and 8). The stylet of the accessory organ is slightly curved and 19 μm long. The pore of the accessory organ is clearly separated from the male and the female genital pore as can be seen in living as well as in sectioned material.

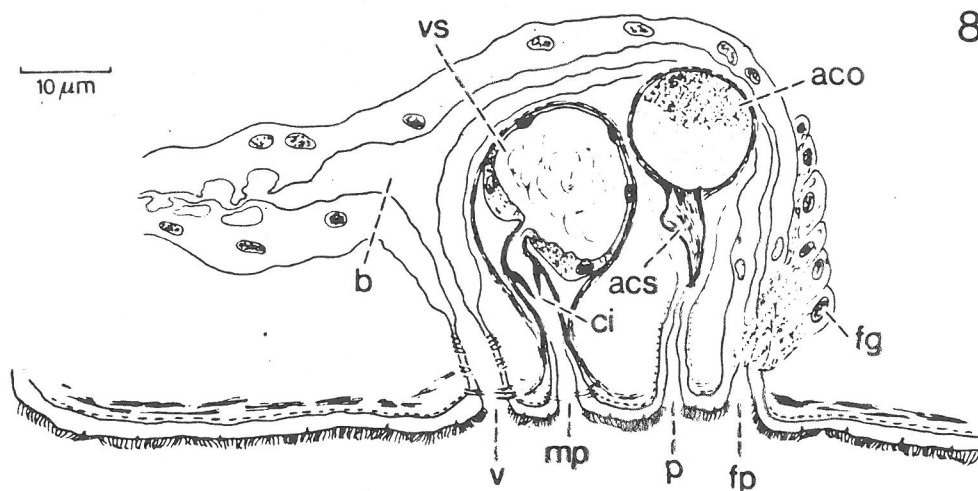


Fig. 8. -*Duplominona paucispina*. Reconstruction of genital organs, from serial sagittal sections (from the left) (Holotype).

The female duct is differentiated in a bursa of the resorbiens type (see Meixner, 1938 p.68) in front of the copulatory organ. Its vagina, surrounded by weakly developed muscles, opens through a pore in front of the male pore distinctly separated from the latter. From the bursa the female duct continues backwards and opens through the female pore, situated behind the accessory organ and surrounded by numerous erythrophilic glands.

Diagnosis.

Slender Duplominona species, 1.4-1.6 μm long, without eyes nor pigment. Cirrus with nine spines, uniform in shape and size, 5-5.6 μm long and 5 μm broad at the base. Stylet of the accessory organ 19 μm long. Vaginal pore, male pore, pore of the accessory organ and female pore separated from each other. Pore relation a:b:c:d:e = 14:2:3:2:14.

DUPLOMINONA CORSICANA sp.n. (Fig. 9-13)

Material.

Several animals studied alive, some of them mounted. Five species sectioned, one of them designated as holotype.

Locality.

Pointe de la Revellata (Bay of Calvi, Corsica) on sandy bottom at 30-40 m depth (type locality). Date : 20.V.83, 3, 4.VII.83, 23.IX.83.

Derivation of the species name.

Refers to the locality where it was found (Corsica).

Description.

The living animals are 2-3 mm long and 0.2 mm broad, without eyes nor pigment and with slightly broadened anterior end (Fig. 9). Oily drops occur in front of the statocyst. The posterior end with adhesive papillae is triangular in shape. The pharynx lies at the front of the last third of the body. Body wall and pharynx are of the same construction as in the bulk of the Monocelididae.

The topography of the genital organs in the living animals can be derived from fig. 9 : ten testes in front of the pharynx (but not neatly lines as in Duplominona paucispina sp.n.), a pair of ovaries just in front of the pharynx and vitellaries stretching from the level of the first testes to just in front of the copulatory organ.

The copulatory bulb is a globular and muscular bulb, about 80-90 μ m long, enclosing the seminal vesicle, the prostate secretion and the cirrus. The cirrus is cylindrical, 20 μ m long and 9 μ m broad over its entire length. Its spines are uniform and 1-1.5 μ m long. In living (Fig.10) and in sectioned material prostate glands are found outside the bulb and enter the bulb from the left and the right side. The secretion is stored in the distal part of the seminal vesicle, without forming a sperated prostate vesicle.

The accessory organ behind the copulatory organ is surrounded by a thick muscular layer and bears a stylet of 20 μ m length. In living and in sectioned animals parts of the glands are found outside the bulb (Fig. 10). The pore of the accessory organ is situated in front of the female pore and clearly separated from the male and female pore.

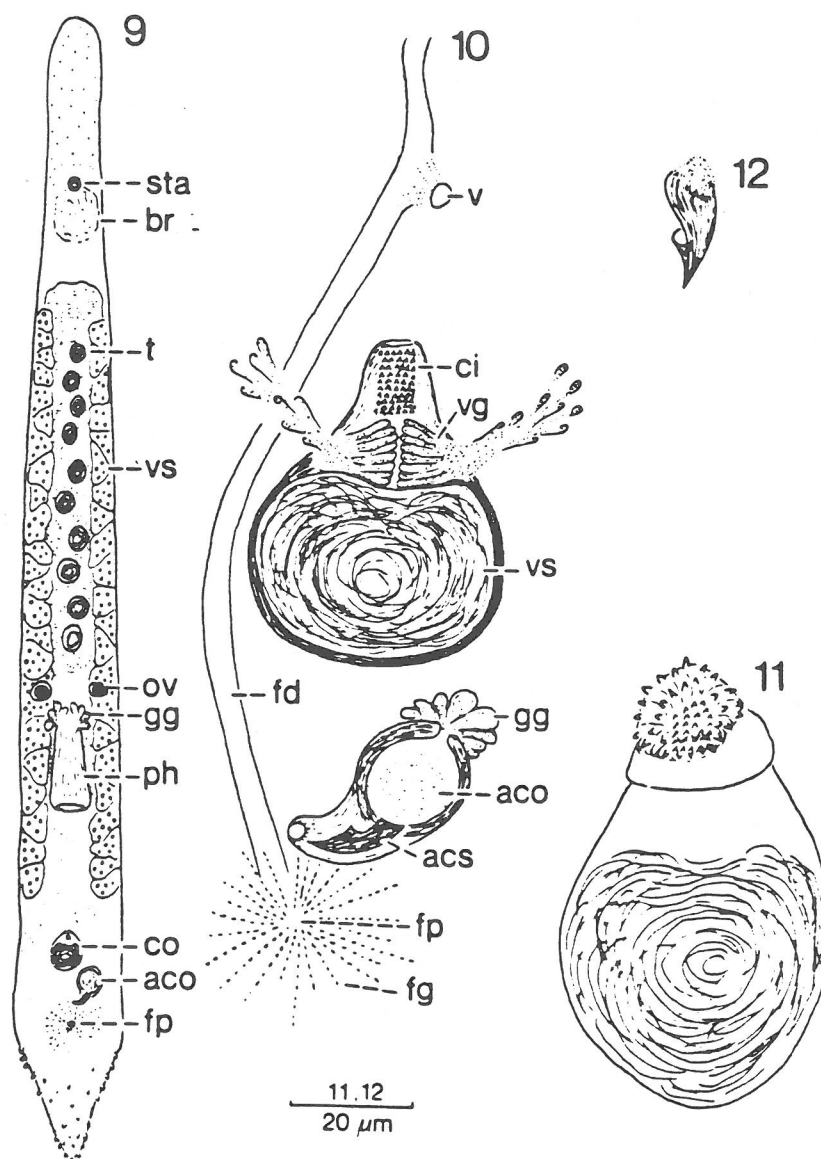
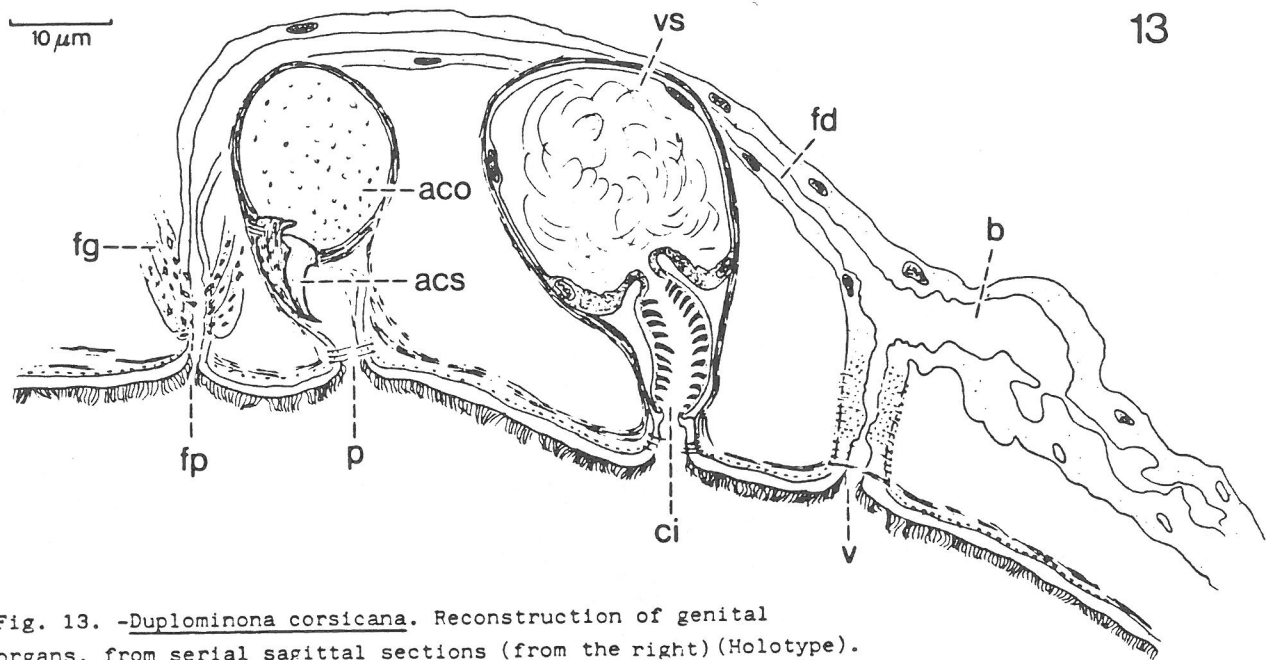


Fig. 9-12. -*Duplominona corsicana*. 9. General organisation of living animals (dorsal view). 10. Genital organs in living animals. 11. Stylet of the accessory organ, from whole mount. 12. Copulatory bulb with everted cirrus, from whole mount.

As in *Duplominona paucispina* sp.n. a non-muscular bursa of the resorbiens type occurs in the female duct, with a vagina surrounded by some weak circular muscles. The female duct ends behind the accessory organ in the female pore which is surrounded by erythrophyllic glands.



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Fig. 13. -*Duplominona corsicana*. Reconstruction of genital organs, from serial sagittal sections (from the right) (Holotype).

Diagnosis.

Slender *Duplominona* species of 2-3 mm long, without eyes nor pigment. Cirrus cylindrical, 20 μm long, with numerous uniform spines of 1-1.5. μm. Stylet of the accessory organ 20 μm long. Pores of the genital organs separated from each other. Pore relation a:b:c:d:e = 22:3:4:2:14.

DUPLOMINONA LONGICIRRUS sp.n. (Fig. 14-18)

Material.

Two animals studied alive and conserved in whole mounts, one of them designated as holotype.

Locality.

Pointe de la Revellata (Bay of Calvi, Corsica) on sandy bottom at 18-30 m depth (type locality). Date : 11.IV.83, 3.VII.83.

Derivation of the species name.

Refers to the very long cirrus of the animal.

Description.

The living animals are 2.7-3 mm long and 0.3 mm broad, without eyes nor pigment. They have rounded anterior and posterior ends, the latter with numerous adhesive papillae. The pharynx with very obvious glands lies just behind the middle of the body.

The topography of the genital organs in the living animals are show in fig. 14 and 16. As can seen in fig. 14 the testes lie in 7-8 pairs in two rows, with the vitellaries from the first pair of testes up to the front of the copulatory organ and the ovaries at the base of the pharynx.

The copulatory organ is extremely elongated (250 μ m) with a cirrus of some 65 μ m long that can extend up to 90 μ m in the living animal. In its wall numerous very fine spines occur, 0.5 μ m long. At the base of the cirrus some glandular secretion can be seen but due to the lack of sectioned material it cannot be ascertained whether a separate prostate vesicle is present. The seminal vesicle (including the part with glandular elements) occupies about 3/4 of the whole bulb and is surrounded by its own muscle layer.

The accessory glandular bulb may also get an elongated shape in the squeezed animals and is surrounded by a thick muscular envelope. The slightly curved stylet is 22 μ m long. The pore of the accessory organ is distinctly separated from the female pore behind it.

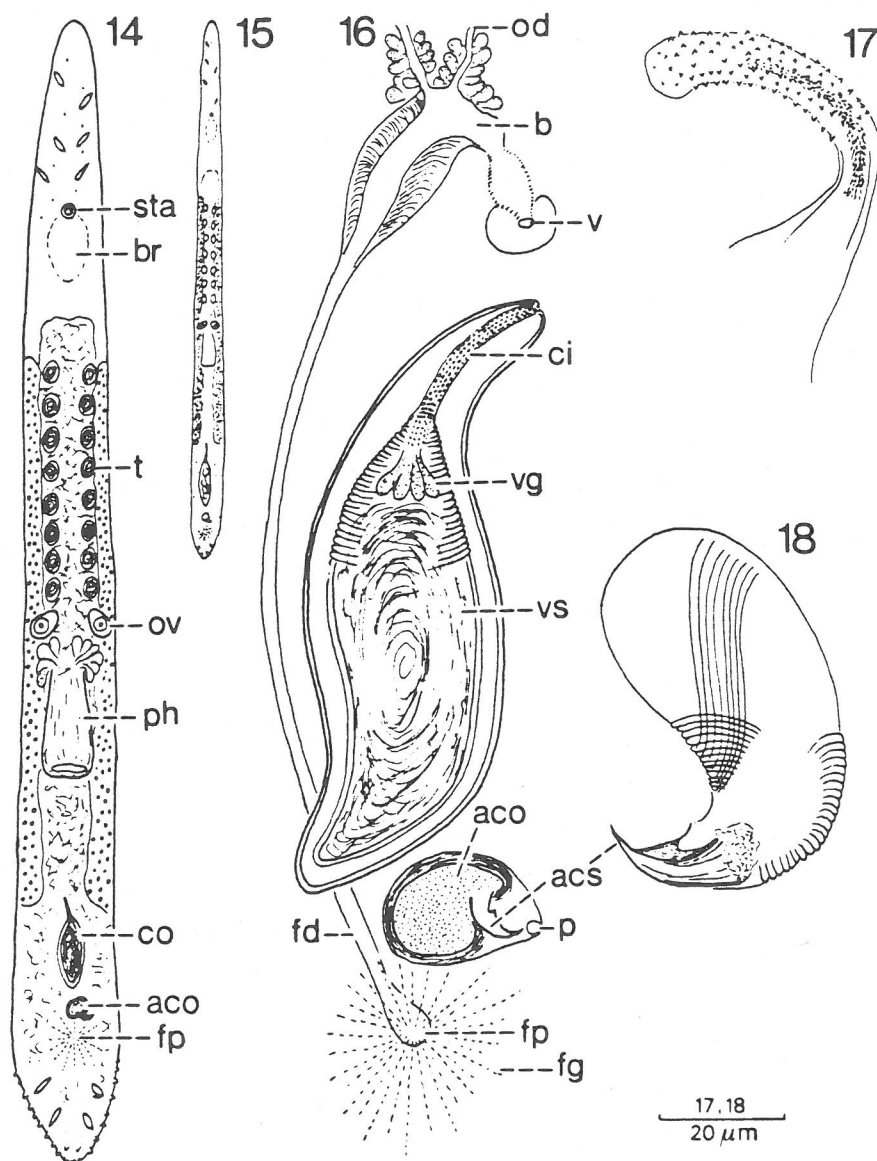


Fig. 14-18. -*Duplominona longicirrus*. 14. Free living animal. 15. General organisation of living animals. 16. Genital organs in living animals. 17. Accessory organ with stylet, from whole mount. 18. Everted cirrus, from whole mount.

The female duct in front of the copulatory organ forms a bursa with a thick muscular wall. The vagina arises from its anterior part, where also both oviducts enter the bursa separately. Some glands seems to be present here but it can be excluded that the oviducts themselves have a tickened wall with resorptive function. The vagina is surrounded by weekly developed circular muscles and its pore is separated from the male genital pore. As usual the female duct continues from the bursa, past the copulatory organ and the accessory organ, to the female ovipository pore which is surrounded by its glands.

Diagnosis.

Duplominona species of 2.7-3 mm long, without eyes nor pigment. Very elongated copulatory organ with a long cirrus of 65 μ m up to 90 μ m long with small spines of 0.5 μ m over its whole length. Stylet of the accessory organ 22 μ m long. Pores of the genital organs separated from each other.

DISCUSSION

The three new species clearly belong to the genus Duplominona Karling, 1966 characterized by : ovaries in front of the pharynx, pharynx behind the body middle, vagina in front of the copulatory organ, the latter of the duplex type, accessory organ behind the copulatory organ and the female ovipository pore behind the latter (for further discussion on the systematics within the subfamily Minoninae : see Martens, 1983).

According to Ax (1977) and Karling (1978) separate pores of the vagina, copulatory organ, accessory organ and female duct represent the "basic" (plesiomorph) condition within the genus. This situation occurs in D. mica (Marcus, 1951), D. tridens (Marcus, 1954), D. amnica (Ball & Hay, 1977), probably also in Duplominona septentrionalis Martens, 1983 and in the three new species here described. D. tridens lacks spines in the cirrus, D. mica has alate expansions at the base of the accessory stylet, and D. septentrionalis has a central stylet in the cirrus. From an anatomical point of view D. amnica, D. paucispina, D. corsicana and D. longicirrus can only be distinguished by the length of the cirrus and the size of the spines. D. amnica however cannot be confounded with the other three

species since it is a large species (4 mm), and it is the only freshwater species known so far within the genus.

In all other Duplominona species the pore of the accessory organ is clearly combined with the female pore (the original description of Duplominona canariensis Ehlers & Ehlers, 1980 is, however, not very clear in this respect) and the majority of these species have the vagina ending in the male atrium (vagina interna). D. istambulensis (Ax, 1959) is the only species of which the vagina has its own pore (vagina externa). The four species from the Galapagos D. karlingi, D. krameri, D. sieversi and D. galapagoensis described by Ax & Ax (1977) have a stylet within the cirrus and of these four species D. sieversi has a cirrus without spines. The three remaining Galapagos species can only be recognised by the size of the cirrus, of the stylet within it and of its spines, while the differences between D. kaneohei Karling et al., 1972 and D. canariensis are mainly differences in the size of the cirrus spines.

It is clear from the short preceding discussion, measurements on the length of the cirrus and size of the spines (preferably in living material or whole mounts) are of major importance for the recognition of the species. In several original descriptions the measurements are lacking. In the identification key below the length of the cirrus and size of the spines are given for most species. Measurements in italics are not from the original description but were derived from measurements of the drawings in the original description (when possible).

Other features may also prove to be important in the future, (such as : degree of development of prostate glands, extra- or intracapsular situation of the glands of the accessory organ, etc.) but a thorough revision of the genus with

a reexamination of the type material is necessary to assess the impact of those other characteristics on the taxonomy and on our knowledge of the phylogenetic relationship between the species.

The identification key below does not reflect any opinions on relationships. It is meant as a "summary" of the main diagnostic characters of the species known within the genus and as a practical tool, also for those not familiar with the Monocelididae.

Identification key to the species of the genus Duplominona.

- 1.-Cirrus without a stylet 2.
 -A stylet within the cirrus 10.
- 2.-Cirrus without spines, the posterior end bears three toes
 with adhesive papillae D. tridens.
 (mediolittoral, coarse sand with detritus, Sao Sebastia,
 Brasil; Marcus, 1954)
- Cirrus with distinct spines 3.
- 3.-Accessory stylet with an alate expansion. Cirrus 50 μ m,
 spines 6 μ m D. mica.
 (infralittoral, 3-5 m, fine to coarse sand, Sao Sebastia,
 Brasil; Marcus, 1951)
- Accessory stylet without an alate expansion 4.
- 4.-Large freshwater species of 4mm length. Cirrus $\pm 100 \mu$ m,
 spines $\pm 6-7 \mu$ m D. amnica.
 (fresh and brackish water, Marquarie Island; Ball & Hay, 1977)
- Marine species 5.
- 5.-Vagina with its own pore (vagina externa) 6.
 -Vagina opens in the male atrium (vagina interna) 9.
- 6.-Pore of the accessory organ combined with female
 ovipository pore. Cirrus with spines (size unknown)
 D. istambulensis.
 (infralittoral, fine to medium sand, Marmara Sea and
 Black Sea; Ax, 1959)
- Pore of the accessory organ clearly separated from the
 female pore 7.

- 7.-Cirrus short with nine spines 5-5.6 μm long and 5 μm broad at the base D. paucispina sp.n.
-Cirrus with numerous spines 8.
- 8.-Cirrus short (20 μm) and cylindrical with numerous uniform spines of 1-1.5 μm D. corsicana sp.n.
-Cirrus very long (65-90 μm) with very small spines, 0.5 μm D. longicirrus sp.n.
- 9.-Cirrus 30 μm long with spines of 10-18 μm (or measurements for the spines are 5-9 μm). Pore of the accessory organ combined with the female pore. D. kaneohei.
(mediolittoral, sand and stones, Coconut Island, Hawaii; Karling et al, 1972)
-Cirrus 30-50 μm long, spines 2 μm long. Pore of the accessory organ unknown D. canariensis.
(mediolittoral, sand, Cran Canaria; Ehlers&Ehlers 1980)
- 10.-Vagina not combined with male atrium (vagina externa).
Cirrus and stylet both 25 μm long. Two types of spines: distal ones 7-9 μm , proximal ones 0.5 μm D. septentrionalis.
(infralittoral, sand between 17 and 40 m depth, North Sea; Martens, 1983)
-Vagina opens in male atrium (vagina interna). Cirrus with uniform spines or no spines at all 11.
- 11.-Cirrus without spines, stylet 32-36 μm long D. sieversi.
(mediolittoral, sand, Santa Cruz, Galapagos; Ax & Ax, 1977)
-Cirrus with spines which may be extremely reduced 12.
- 12.-Cirrus spines extremely reduced, stylet 22-24 μm long D. krameri.
(mediolittoral, coarse sand, Santa Cruz, Galapagos; Ax & Ax, 1977)
-Cirrus spines clearly present 13.
- 13.-Stylet 22-23 μm long, cirrus a little longer, spines 3-3.5 μm long D. karlingi.
(medio- and infralittoral, sand, Santa Cruz, Galapagos; Ax & Ax, 1977)
-Stylet 45 μm long, cirrus \pm 30 μm and spines \pm 2 μm long D. galapagoensis.
(infralittoral, sand between 1-60 m depth, Santa Cruz, Galapagos; Ax & Ax, 1977)

Abbreviations in the figures

aco	: accessory organ
acs	: accessory stylet
b	: bursa
br	: brain
ci	: cirrus
co	: copulatory organ
fd	: female duct
fg	: female glands
fp	: female pore
gg	: glands
mp	: male pore
od	: oviduct
ov	: ovary
p	: pore
pg	: prostate glands
ph	: pharynx
sta	: statocyst
t	: testes
v	: vagina
vg	: prostate vesicle
vi	: vitellary
vs	: seminal vesicle

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